sion (U. S. series No. XVIII) that had passed over the Gulf of Saint Lawrence on the 25th and moved rapidly northeastward stretched as a long oval from Iceland to North Cape, while a following depression, *F*, was central at N. 50°, W. 50°, near the coast of Labrador and Newfoundland. The barometer was at this time quite low over all of Europe north of N. 50°, but high over the Atlantic and the United States south of N. 40°.

F. This area (U. S. series No. XIX) seems to have developed on the 26th off the coast of the south Atlantic States as the result of the flow of cold northwest winds over the warm waters of the Gulf Stream; it had had a previous existence as an unimportant whirl in the Gulf southwest of Florida, having apparently been started on the southeast side of the norther that swept over the western portion of the Gulf on the 24th and 25th. On the 27th the center was about N. 41°, W. 68°; 28th, N. 48°, W. 50°; 29th, it was north of our stations and reports, but on the 30th the center must have been, approximately, N. 63°, W. 8°.

G. On the 29th, a. m., a depression (U. S. series No. XXI) was east of the south Atlantic coast moving northward; this also had a previous existence as an unimportant depression in the Gulf, having originated on the southeast side of the northerly winds that prevailed in the western Gulf on the 28th; it passed inward over Chesapeake Bay on the 29th, and by the 30th, noon, it had united with a depression coming from the west and constituted a violent storm central a little east of Boston; 31st, noon, the center was near the southern coast of Newfoundland, while the preceding area, *F*, was central near the southern coast of Norway. At this time the isobar of 29.9 passed from St. Petersburg southwest to northern Spain and Portugal, thence northwest to N. 55°, W. 20°, thence southwest to N. 37°, W. 55° and 60°, thence northwest to Quebec, and the entire region north of this line was dominated by the low areas *F* in the east and *G* in the west.

It has often been pointed out that the formation of a norther in Texas and the Gulf of Mexico is due sometimes to the unusual coldness and density of the air that is flowing southward from the Mexican and United States Rocky Mountain plateau region, but that sometimes also it must be due to a slight deficit of pressure in regions far to the south, as a gradient of 0.01 of an inch per degree suffices to set the mobile atmosphere in rapid motion. In this connection the few reports that we have received from the southern portion of the Caribbean Sea are interesting, as they indicate that the pressure was about 0.1 of an inch, or 0.05 below the normal, in that region from January 15–22, but had risen to normal by the end of the month. A daily barometric report from the coasts of Venezuela, Central America, Guatemala, and Mexico would undoubtedly give a satisfactory basis for predicting the northers of the Gulf and the Caribbean Sea.

OCEAN ICE IN JANUARY.

The limits of the regions within which field ice or icebergs were reported for January, 1894, are shown on Chart I by crosses. The southernmost ice reported was in N. 44° 27′, W. 54° 15′, on the 18th, and the position of the easternmost ice was reported in N. 44° 48′, W. 46° 14′, on the 21st. More ice was reported during January, 1894, than in any corresponding month during the past 12 years. In 1893, on January 5, a large berg was noted in N. 47° 35′, W. 48° 34′; on the 8th a long, low berg was observed in N. 48° 10′, W. 47° 26′; on the 18th a berg was noted in N. 48°, W. 46°. In 1889 and 1892 no ice was reported. In 1891, on the 28th, 3 large icebergs were observed in N. 46° 30′, W. 52° 46′, and on the 31st patches of soft ice were encountered in N. 45° 50′, W. 59° 20′. In 1890 vast fields of ice and enormous icebergs were encountered over and near the Grand Banks, north of the forty-third parallel. In 1882 to 1888, inclusive, Arctic ice in small quantities was reported east of Newfoundland, but in no case was it sighted south of the forty-third parallel.

OCEAN FOG IN JANUARY.

The limits of fog belts west of the fortieth meridian, as reported by navigators, are shown on Chart I by dotted shading. Near the Banks of Newfoundland fog was reported on 9 dates; between the fifty-fifth and sixty-fifth meridians on 5 dates, and west of the sixty-fifth meridian on 4 dates. Compared with the corresponding month of the last six years the dates of occurrence of fog east of the fifty-fifth meridian numbered 2 more than the average; between the fifty-fifth and sixty-fifth meridians 4 less than the average; and west of the sixty-fifth meridian 2 less than the average.

TEMPERATURE OF THE AIR.

[*In degrees Fahrenheit.*]

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are drawn over the higher irregular surface of the Rocky Mountain plateau, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; in mountainous regions such isotherms are controlled largely by the topography, and it is, therefore, not practicable to accurately present the temperature data in this manner unless a contour map on a large scale is published as a base chart.

NORMAL TEMPERATURE.

In the table of meteorological data from voluntary observers only the mean temperature is given for each station, but in the tables of climatological data for the regular stations of the Weather Bureau both the mean temperatures and the departures from the normal are given. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal. The normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

MONTHLY MEAN TEMPERATURE.

For the regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to the table of meteorological data.

During January, 1894, the mean temperature was highest at Key West, Fla. (71.0), and was above 60 in the Florida Peninsula and extreme southeastern coast of Louisiana and the extreme southern portion of Texas. The temperature averaged 32 in a zone passing from Cape Cod, Mass., through Long Island Sound, northern New Jersey, central Pennsylvania, northern Ohio and Indiana, southern Michigan, central Illinois and Missouri, southern Kansas, northern Texas, New Mexico, Arizona, portions of Nevada, Oregon, and Washington. The lowest average temperatures in the United States were between zero and —4.7 in the Red River Valley between Minnesota and North Dakota. The isotherm of —10 passes through Manitoba and Saskatchewan.

DEPARTURES FROM NORMAL TEMPERATURE.

As compared with the normal for this month temperatures were slightly deficient at the mouth of the St. Lawrence River and more so in North and South Dakota and still more so in Arizona and California; the maximum deficits were —4.2 at Tucson and San Diego. Excepting these small regions the greater portion of the country had a mean temperature decidedly above the normal; the maximum excesses were in the Mississippi and Ohio valleys and lower Lake region, where they ranged from +8.6 at Memphis, Tenn., to +4.2 at New Orleans, La.; +8.5 at Toronto, Ont.; +4.0 at Duluth, Minn.; +4.7 at Denver, Colo.; the temperatures in Alberta, Saskatchewan, and Assiniboia were also from 6 to 4 above the normal.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for January for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for January, 1894; (4) the departure of the current month from the normal; (5) the extreme monthly means for January and the years of their occurrence during the period of observation:

State and station.	(1) Normal for the month of Jan.	(2) Length of record.	(3) Mean for Jan., 1894.	(4) Departure from normal.	(5) Extreme monthly means for January.			
					Highest.	Year.	Lowest.	Year.
Arizona.	°	Years	°	°	°		°	
Fort Apache	34.9	22	32.8	— 2.1	39.8	1882	27.4	1874
Fort Mohave	51.5	21	.....	.....	56.4	1879, 93	44.0	1890
Whipple Barracks	35.4	22	31.8	— 3.6	40.7	1871, 93	27.5	1888
Arkansas.								
Keesees Ferry	33.3	12	39.3	+ 6.0	45.6	1890	24.2	1886
California.								
Riverside	50.8	12	47.3	— 3.5	54.6	1893	43.0	1890
Colorado.								
Las Animas	24.2	12	31.4	+ 7.2	34.6	1893	16.4	1885
Florida.								
Merritts Island	62.1	12	65.9	+ 3.8	69.8	1882	55.4	1886
Georgia.								
Forsyth	47.8	20	52.7	+ 4.9	59.4	1880	40.8	1884
Idaho.								
Boise Barracks	28.3	20	32.2	+ 3.9	39.2	1874	17.7	1888
Fort Sherman	25.2	10	.....	.....	34.4	1891	18.8	1890
Indiana.								
Lafayette	23.5	14	32.0	+ 8.5	41.3	1880	13.5	1893
Iowa.								
Cresco	9.5	22	15.0	+ 5.5	26.1	1880	— 1.3	1883
Kansas.								
Eureka Ranch	23.9	11	26.0	+ 2.1	31.0	1893	14.7	1886
Independence	29.1	22	32.3	+ 3.2	45.8	1880	18.6	1886
Louisiana.								
Grand Coteau	51.6	11	55.4	+ 3.8	64.0	1890	47.2	1892
Maine.								
Orono	15.7	19	12.4	— 3.3	24.7	1889	8.2	1875
Maryland.								
Cumberland	29.7	23	35.0	+ 5.3	40.7	1890	22.8	1893
Michigan.								
Kalamazoo	21.7	18	28.8	+ 7.1	36.0	1880	14.0	1881
Missouri.								
Sedalia	24.6	11	30.9	+ 6.3	35.6	1889	13.6	1887
Montana.								
Fort Custer	12.5	14	19.4	+ 6.9	28.6	1891	2.2	1886
Nebraska.								
Fort Robinson	21.8	9	20.4	— 1.4	29.4	1893	15.7	1890
Genoa (near)	16.4	18	17.9	+ 1.5	29.2	1880	5.0	1886
Nevada.								
Browns	31.3	23	.....	.....	39.6	1873	19.0	1888
Carson City	30.4	17	32.0	+ 1.6	37.0	1881	18.9	1890
New Hampshire.								
Hanover	17.3	23	20.3	+ 3.0	25.4	1889	6.8	1888
New Mexico.								
Deming	42.8	11	44.9	+ 2.1	50.4	1893	36.8	1883
Fort Wingate	30.1	23	31.2	+ 1.1	36.8	1877	23.8	1878
New York.								
Cooperstown	20.1	23	25.5	+ 5.4	31.6	1880	12.3	1875
Plattsburg Barracks	16.5	23	19.2	+ 2.7	27.4	1880	8.8	1893
North Carolina.								
Lenoir	35.9	22	41.3	+ 5.4	46.5	1890	27.3	1893
Oklahoma.								
Fort Reno	32.6	11	.....	.....	40.2	1893	23.0	1886
Fort Sill	36.0	22	37.7	+ 1.7	48.1	1880	25.7	1875
Fort Supply	29.7	15	30.2	+ 0.5	37.2	1893	19.7	1875
Oregon.								
Bandon	43.5	10	46.0	+ 2.5	48.8	1891	39.6	1888
Pennsylvania.								
Dyberry	21.4	23	26.6	+ 5.2	31.6	1890	14.1	1893
Grampian	22.8	23	30.2	+ 7.4	35.0	1880	15.0	1893
Wellsboro	24.7	14	28.6	+ 3.9	35.8	1890	15.8	1893

Departures from normal temperature—Continued.

State and station.	(1) Normal for the month of Jan.	(2) Length of record.	(3) Mean for Jan., 1894.	(4) Departure from normal.	(5) Extreme monthly means for January.			
					Highest.	Year.	Lowest.	Year.
South Carolina.	°	Years	°	°	°		°	
Statesburg	44.7	12	49.2	+ 4.5	54.6	1890	38.0	1893
South Dakota.								
Fort Sully	12.3	23	13.5	+ 1.2	30.3	1891	0.1	1875
Texas.								
Austin	47.8	22	53.1	+ 5.3	59.5	1880	40.0	1892
Silver Falls	41.0	8	41.6	+ 0.6	46.6	1890	36.2	1892
Utah.								
Terrace	22.6	22	28.9	+ 6.3	31.4	1872	9.8	1888
Vermont.								
Strafford	16.0	20	25.1	+ 9.1	25.4	1889	6.9	1888
Virginia.								
Dale Enterprise	32.0	14	36.4	+ 4.4	48.1	1890	20.7	1881
Washington.								
Fort Townsend	37.9	19	37.7	— 0.2	55.4	1888	30.3	1875
West Virginia.								
Parkersburg	31.1	13	37.0	+ 5.9	42.4	1890	21.9	1893
Wisconsin.								
Madison	15.9	23	20.6	+ 4.7	33.6	1880	4.1	1875
Wyoming.								
Fort Washakie	13.2	11	20.6	+ 7.4	29.6	1893	6.6	1888

YEARS OF HIGHEST MEAN TEMPERATURE FOR JANUARY.

The mean temperature for January, 1894, was not the highest on record at any reporting station during the current month, notwithstanding the fact that so large a region has enjoyed a temperature so decidedly above the normal. The distribution of temperature during the current month was, in fact, approximately, a combination, on a more moderate scale, of the distribution of high temperatures during the same month in 1880, 1890, and 1891.

YEARS OF LOWEST MEAN TEMPERATURE FOR JANUARY.

The mean temperature for January 1894, was the lowest on record at Tucson, Ariz., being 45.2, or 4.2 below the normal, the previous lowest being 45.4 in January, 1878; at San Diego, Cal., being 49.5, or 4.2 below the normal, the lowest previous temperature for January was 50.4 in 1882.

MAXIMUM TEMPERATURE.

The maximum temperatures at regular stations of the Weather Bureau are given in the table of climatological data, from which it appears that temperatures from 80 to 82 have been recorded at Corpus Christi and San Antonio, Tex., Key West, Tampa, Jupiter, and Titusville, Fla. Among the lowest maxima are: Moorhead, Minn., 38; Sault Ste. Marie, Mich., 40; St. Paul, Minn., 43; Huron, N. Dak., 42; Marquette, Mich., 45; Bismarck, N. Dak., 45; St. Vincent, Minn., 46; and Miles City, Mont., 46. This region of lowest maxima corresponds nearly to the interior region whose elevation is less than 2,000 feet above sea level.

MINIMUM TEMPERATURE.

The lowest temperatures recorded at regular stations of the Weather Bureau are given in the table of climatological data, from which the following are selected: Key West, Fla., 61; Jupiter, Fla., 49; Tampa, Fla., 41; Titusville, Fla., 40; Jacksonville, Fla., 36; Savannah, Ga., 32; Mobile, Ala., 24; New Orleans, La., 28; Galveston and Corpus Christi, Tex., 24; El Paso, Tex., 14; Tucson, Ariz., 18; Yuma, Ariz., 28; San Diego and Los Angeles, Cal., 32; San Francisco, Cal., 36. On the northern border the following are the lowest minima: Eastport, Me., —9; Sault Ste. Marie, Mich., —14; Marquette, Mich., —9; Duluth, Minn., —24; St. Vincent, Minn., —38; Williston, N. Dak., —36; Havre and Helena, Mont., —26; Spokane Falls, Wash., —1; Tatoosh Island, Wash., 30.

TEMPERATURE, JANUARY 1 TO 31, 1894.

For the period January 1 to 31, 1894, the average temperature was above the normal throughout the whole country,

except in the southern plateau, middle Pacific, and southern Pacific. In regions where the temperature was deficient the average deficit for the period was as follows: southern Pacific, 2.4; southern plateau, 1.8; middle Pacific, 1.7.

In regions where the temperature was in excess the average excess for the period was as follows; North Dakota, 0.1; Key West, Fla., 0.6; north Pacific coast, 1.1; northern slope, 2.0; middle plateau, 2.4; New England, 2.4; Missouri Valley, 2.5; south Atlantic States, 2.9; middle Atlantic States, 4.2; northern plateau, 4.6; Abilene, Tex. (southern slope), 4.7; east Gulf States, 4.7; upper Mississippi Valley, 4.9; middle slope, 4.9; west Gulf States, 5.3; upper Lake region, 5.4; lower Lake region, 6.3; Ohio Valley and Tennessee, 6.6.

DIURNAL PERIODICITY.

The regular diurnal period in temperature is shown by the hourly means given in meteorological table No. V for all stations having self-registers.

DAILY AND MONTHLY RANGES OF TEMPERATURE.

The greatest daily range of temperature is given for each of the regular Weather Bureau stations in Table I of climatological data from which the following are selected.

Greatest daily ranges.—Havre, Mont., 59; Huron, S. Dak., 56; Williston, N. Dak., and Pueblo, Colo., 52; Cheyenne, Wyo., 50.

Smallest daily ranges.—Key West, Fla., Fort Canby and Tatoosh Island, Wash., 13; Eureka, Cal., 16; San Francisco, Cal., 17; Port Eads, La., 18; Hatteras, N. C., 19; Woods Holl, Mass., 20. Daily ranges of about 40 or more were reported from the greater portion of Montana, North and South Dakota, Wyoming, Colorado, and small portions of Kansas, Nebraska, Iowa, Missouri, and Minnesota.

Monthly ranges of 60 or more were reported from the region inclosed by the states of Montana, Wyoming, Colorado, Texas, Ohio, and Wisconsin.

Largest monthly ranges.—Columbia, Mo., 90; Concordia, Kans., 89; Springfield, Mo., 87; Keokuk, Iowa, and Hannibal, Mo., 85.

Smallest monthly ranges.—Key West, Fla., 19; Fort Canby, Wash., 21; San Francisco, Cal., 22; Hatteras, N. C., 29; Tatoosh Island, Wash., 30.

LIMITS OF FREEZING TEMPERATURE.

The southern limit of the region within which the air has had a freezing temperature at some time during the month is approximately shown by the full and dotted lines on Chart V, joining the places at which the minimum temperatures of 32° and 40°, respectively, occurred within the instrument shelters of the Weather Bureau; the latter minimum is usually accompanied by a more or less severe frost on the ground outside of the shelter. During January, 1894, the line of minimum 40° crosses the northern portion of the peninsula of Florida just above the stations of Tampa and Titusville; it does not reappear either on the Gulf or the California coast within the limits of the United States. The line of minimum 32° passes from Savannah, Ga., southwest to near Apalachicola, in northern Florida; it reappears on the Pacific coast at San Diego, and leaves that coast between San Francisco and Eureka, Cal., at N. 40°.

PERIODS OF HIGH TEMPERATURE.

The most interesting period of high temperature began on the 11th and 12th in Oregon and Washington; it extended eastward on the 13th over Idaho, Montana, and North Dakota; on the 14th and 15th it prevailed over Lake Superior, Wyoming, Utah, and Colorado; on the 16th the highest temperatures of the month occurred in northern Texas, Oklahoma, Arkansas, Kansas, Nebraska, and Iowa; on the 17th, in Missouri, Illinois, Indiana, and Michigan; this warm period disappeared on the 18th with a few maxima in Louisiana and Pennsylvania.

PERIODS OF LOW TEMPERATURE.

The first part of January was remarkably cold in California; the minimum temperatures generally occurred on the 6th, but a few on the 5th or 7th.

The most extensive period of low temperature began on the 23d, in Montana; the minimum for the month occurred on the 24th in North and South Dakota, Minnesota, Nebraska, Kansas, Oklahoma, and northern Texas; on the 25th in Upper and Lower Michigan, Wisconsin, Illinois, Indiana, Ohio, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, and southern Texas; 26th, in western New York, Pennsylvania, Maryland, Delaware, New Jersey, Virginia, North and South Carolina; this cold wave disappeared on the 27th and 28th on the south Atlantic coast. A special bulletin was published by order of the Chief of the Weather Bureau on January 24, at 10.45 a. m., as follows:

> The cold wave which was reported in the extreme Northwest on Saturday last has moved slowly to the southeast, and now covers the Mississippi Valley and the region westward to the Rocky Mountains.
>
> The low temperatures attending this cold wave are unusual, especially in the Southwest, including northern Texas, Oklahoma, Indian Territory, and Arkansas, where the temperature is lower this morning than it has been for many years.
>
> It is 8° below zero in Oklahoma. It is 8° above zero at Palestine, Tex. It is below freezing on the Texas coast. It is 10° below zero at St. Louis, Mo., and the temperature has fallen from 35° to 45° in Missouri in the past 24 hours. It is from 30° to 48° below zero in the Northwest, but the temperature is rising in Montana.
>
> This cold wave will extend eastward over the Atlantic coast Thursday, preceded by rain or snow, and followed by fair and very cold weather Thursday and Friday.

AREAS OF 20° FALL IN TWENTY-FOUR HOURS.

A fall of 20° or more in temperature in twenty-four hours is known in the Weather Bureau forecasts as a cold wave, provided the temperature falls below 40° F. These falls in temperature are computed from observations twenty-four hours apart and are, therefore, largely independent of the regular diurnal variation of temperature; they may be divided into 2 classes: (1) those due to the clearing away of cloudy skies and the fall of temperature due to the consequent local radiation at the station; (2) those due to the advent of cold winds usually called a cold wave; the latter areas of low temperature are usually persistent for several days; they form on the east side of the Rocky Mountains in British America and advance southward and eastward over the country with a well-defined front, sometimes attended by snow squalls, when they are called blizzards, and sometimes by severe dry northerly winds, when they are called northers. The cold layer of air is often comparatively shallow; it does not easily push up over the Rocky Mountain plateaus of the United States or Mexico, but frequently surmounts the lower portions of the Appalachian range and descends upon the middle and east Atlantic coasts.

The following list gives all the regions inclosed by heavy dotted lines on the published Daily Weather Maps for January as having experienced falls of 20° in twenty-four hours. The area covered in each case is shown by the dimensions in miles; when one of the dimensions is left blank it will be understood that the region extended beyond the limits of our stations:

(A) 1st, 8 p. m., over an area 500 by 250 miles in western Montana, Alberta, and Assiniboia. 2d, 8 a. m., about 600 miles in diameter, the southeastern edge being in the western portion of South Dakota; 8 p. m., about 800 by 400 miles, the southern edge being in western and central Nebraska. 3d, 8 a. m., broken up into two small areas of 300 by 200 miles, the southern edge being still in Nebraska; 8 p. m., one small area left, 300 by 200 miles, the southern edge covering central

Kansas. 4th, 8 a. m., 200 by 150 miles, in southeast Minnesota and western Wisconsin.

(B) 4th, 8 p. m., 250 by 200 miles, in western Montana and southern Alberta. 5th, 8 a. m., 500 by 300 miles, in western Alberta and Assiniboia; 8 p. m., 800 by 300 miles, from Manitoba south to Colorado and western Nebraska. 6th, 8 a. m., 250 by 400 miles, over Colorado, northern Texas, western Kansas, and Nebraska; 8 p. m., 350 by 200 miles, over Oklahoma and northeastern Texas.

(C) 5th, 8 a. m., 500 by —— miles, covering Ontario. 5th, 8 p. m., 300 by —— miles, covering New Brunswick and the mouth of the St. Lawrence. 6th, 8 a. m., 300 by 400 miles, covering Maine, Nova Scotia, and New Brunswick.

(D) 5th, 8 p. m., 400 by 100 miles, in the Ohio Valley.

(E) 6th, 8 a. m., 250 by —— miles, in Alberta and Saskatchewan. 6th, 8 p. m., the cold area was partly annulled by warm weather and then immediately followed by a decided fall. 7th, 8 a. m., 700 by 300 miles, covering Minnesota, Wisconsin, and northern Illinois.

(F) 8th, 8 a. m., about 200 by 400 miles, over western Virginia, North Carolina, and northern Georgia.

(G) 9th, 8 p. m., 300 by 250 miles, over Oklahoma and northeastern Texas.

(H) 10th, 8 a. m., 300 by —— miles, over New Brunswick and the mouth of the St. Lawrence River.

(I) *10th, 8 p. m., 300 by 200 miles, over northwest Montana* and southern Alberta. 11th, 8 a. m., 650 by 450 miles, covering Montana, eastern Wyoming, and western Nebraska; 8 p. m., 400 by 300 miles, over southern Minnesota and northern Iowa.

(J) 11th, 8 p. m., 700 by —— miles, over Manitoba and northern Lake Superior. 12th, 8 a. m., 500 by —— miles, over Lake Huron and northward; 8 p. m., 600 by —— miles, over the St. Lawrence Valley and New England. 13th, 8 a. m., 300 by 200 miles, over Maine and the lower St. Lawrence Valley.

(K) 14th, 8 a. m., 400 by —— miles, over Alberta and western Assiniboia; 8 p. m. 1,100 by —— miles, over Alberta to Manitoba and northward. 15th, 8 a. m., in Manitoba; 8 p. m., 300 by —— miles, north of Lake Superior. 16th, 8 a. m., north of Lake Superior and Lake Huron; 8 p. m., north of lakes Huron and Ontario. 17th, 8 a. m., 800 by —— miles, covering northern New England, Nova Scotia, Cape Breton, New Brunswick, the St. Lawrence, and northward.

(L) 17th, 8 a. m., 100 by 200 miles in Manitoba; 8 p. m., 200 by 400 miles over Manitoba and northern Minnesota; also 200 by 500 miles over eastern Kansas, Nebraska, and western Iowa. 18th, 8 a. m., about 300 by 1,500 miles over eastern Colorado, northern Texas, eastern Kansas, western Missouri, Iowa, Minnesota, and Manitoba; 8 p. m., about 500 by 300 miles over Missouri and Illinois. 19th, 8 a. m., about 1,000 by 200 miles from southern Illinois northeast to Lake Huron and beyond; 8 p. m., 100 by 400 miles over northern New England and New Brunswick. 20th, 8 a. m., 800 by 300 miles over eastern New York, Vermont, New Hampshire, Maine, New Brunswick, and the St. Lawrence Valley.

(M) 19th, 8 a. m., 500 by 300 miles over Alberta, Assiniboia, Saskatchewan; 8 p. m., 300 by 200 miles over western Montana, Assiniboia, and Manitoba; 20th, 8 a. m., 200 by 400 miles over Manitoba; 8 p. m., 100 by —— miles over Manitoba.

(N) *20th, 8 p. m., 200 by 300 miles over portions of Mon*tana, Alberta, and Assiniboia; 21st, 8 a. m., 100 by 800 miles over South Dakota and southern Montana; 8 p. m., 1,300 by 300 miles over North and South Dakota, eastern Nebraska, Lake Superior, and portions of Minnesota, Wisconsin, and Iowa. 22d, 8 a. m., 1,500 by 300 miles over eastern Colorado, Kansas, Nebraska, Iowa, Wisconsin, Lake Superior, and portions of Ontario; 8 p. m., the large area is broken up into three parts, viz, 100 by 300 miles over Oklahoma and northern Texas; 100 by 200 miles over Missouri and Illinois; 700 by —— miles over Ontario and Quebec. 23d, 8 a. m., 700 by —— miles over the St. Lawrence and New Brunswick.

(O) 21st, 8 a. m., 800 by 400 miles in the lower Mississippi valley.

(P) 22d, 8 p. m., 100 by 200 miles in western Montana. 23d, 8 a. m., 100 by 600 miles over western Montana and central Wyoming; 8 p. m., 400 by 1,100 miles over Wyoming, Idaho, eastern Colorado, western Nebraska, western Missouri, Kansas, Oklahoma, and northern Texas. 24th, 8 a. m., 1,400 by 700 miles over eastern Colorado and New Mexico, northeastern Mexico, Texas, Oklahoma, Arkansas, Missouri, Illinois, portions of Louisiana, Kansas, and Iowa. 24th, 8 p. m., 1,500 by 500 miles over southern Texas, northeast Mexico, the western portion of the Gulf of Mexico, Louisiana, Mississippi, Alabama, Arkansas, Tennessee, Kentucky, Illinois, Indiana, Ohio. 25th, 8 a. m., 1,400 by 400 miles over Mississippi, Alabama, Tennessee, Kentucky, Ohio, Ontario, and portions of Georgia, Indiana, West Virginia, Pennsylvania, New York, and Michigan; 8 p. m., 1,200 by 500 miles over South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, and portions of Pennsylvania, New York, Ontario, New Brunswick, Nova Scotia, and the ocean between this shore line and the Gulf Stream. 26th, 8 p. m., the large area divided into two portions, viz, 200 by 100 miles on the coast of South Carolina, and 500 by —— miles over New Brunswick, Nova Scotia, and the Gulf of St. Lawrence.

(Q) 29th, 8 a. m., 500 by 200 miles over portions of North and South Dakota, Minnesota and Nebraska; 8 p. m., 200 by 100 miles over northern Illinois and Indiana; 30th, 8 a. m., 300 by 100 miles over northern Indiana and Ohio.

(R) 30th, 8 a. m., 100 by 100 miles in the Florida Peninsula.

(S) 29th, 8th p. m., 200 by —— miles in Alberta. 30th, 8 a. m., 500 by 200 miles over portions of Montana, Assiniboia, and Saskatchewan; 8 p. m., 600 by 300 miles over eastern Wyoming, northern Colorado, western portions of North Dakota, South Dakota, Nebraska, and Kansas. 31st, 8 a. m., 300 by 150 miles over portions of Manitoba, North Dakota, and Minnesota; 31st, 8 p. m., 800 by 200 miles over northern Texas, Oklahoma and Indian Territory, central Missouri and Illinois.

(T) 31st, 8 p. m., 400 by —— miles over the southern coast of the Gulf of St. Lawrence.

AGRICULTURE AFFECTED BY TEMPERATURE.

The following records of cold and warm periods are taken from the reports of the State Weather Services:

Alabama.—The coldest weather occurred during the night of the 24th; at Montgomery, about 2 p. m., the wind rapidly increased to 30 miles per hour from the northwest, with a rapid fall in temperature, and by the morning of the 25th temperature had fallen 44° to the minimum of 21°. In some places strawberry plants and young cabbages were destroyed, but young oats fared better, only those in the bud being killed. The approach of this cold wave was amply foretold by the Weather Bureau in a general warning on the night of the 23d, which was repeated to all regular display stations in the State; it is thought that this warning saved many thousands of dollars.

Arkansas.—The chief meteorological feature of the month was the cold wave of the 24th, which was the most severe for fifteen years, except that of January 9, 1886.

California.—Anderson.—The month has been cold and frosty. Clipper Mills.—The first portion of the month was very cold and injurious to young grass. *Cornwall.—The frosts of the early part of the month kept* the crops back. Colegrove.—From the 4th to the 10th and on the 17th a light white frost was observable in the early morning; even light frost is quite unusual here; in exposed places the tender growth on tomato vines was somewhat touched. Escondido.—Quite a cold snap during the first half of the month; the only citrus trees damaged were the few that were situated in the lowest places; it was the longest cold snap for years; vegetables are backward owing to chilling weather. Fall Brook.—The number of frosts in January, 1894, was 16, and greater than the aggregate for the past six Januarys; in the past sixteen years the greatest number of frosts for any one January was 7, and in four Januarys there were no frosts. Jolon.—Frost and freezing

weather nearly all the month. Lemoore.—Unusually cold weather, such as was never experienced here before. North Hill Vineyard.—The first killing frost was on the 25th. Pasadena.—The lowest average temperature ever known here; the extreme cold lasted only a very short time; tender plants were cut down, but no damage to oranges. Red Bluff.—A little wetter and cooler than the average; fine growing weather. Sacramento.—The month has been remarkably cold; ice ¼ of an inch thick on the mornings of the 4th, 5th, 9th, 10th, and 19th, ½ of an inch on the 6th, and ⅛ of inch on the morning of the 7th. San Jose.—The month is noted for one of the coldest nights for years; minimum temperature, 18°, on the morning of the 6th; the previous lowest was 22°; flowers and shrubs were injured more than usual in this valley. Santa Cruz.—Ground frozen slightly on the 3d, and very hard on the 5th and 6th; ice ¼ of an inch in thickness; calla lilies and tender plants frozen to the ground. San Ardo.—More killing frost than usual; the sowing of grain will not be finished before March 1. Santa Barbara.—The month was unusually cold; frosts on eleven mornings and ice on six, but only delicate plants were injured. Santa Maria.—Cold and frosty until the 20th; grain coming up slowly. Turlock.—Ice on the mornings of the 5th, 6th, 8th, 9th, 10th, 11th, 12th, and 18th; mean monthly temperature about the same as last year; comparatively few entirely foggy days; grain is not much, if any, further advanced than last year, but is in better condition. Tehachapi.—The first part of this month was the coldest for years. Ventura.—The coldest month known in this county; there was more frost than usual, but not of the killing kind.

Illinois.—A severe cold wave prevailed over the State on the 24th and 25th, but owing to the snow that had fallen during the two preceding days the wheat was well protected from the intense cold.

Iowa.—Blizzards were reported at Grand Meadow on the 11th; at Carroll, Greenfield, and Rockwell City, on the 23d; the lowest temperature occurred at Amana on the 25th.

Louisiana.—The marked feature of the weather of January, 1894, was the cold wave of the 24th to 26th that caused temperature falls of 30° to 40° in all portions of the State; this had been heralded by warnings sent broadcast by telegraph, telephone, and mail. The lowest temperature in northern Louisiana was 12°, in southeastern Louisiana, at Port Eads, 40°, and at New Orleans, 28°. Garden vegetables were injured and possibly some slight injury to orange trees, but severe injury was sometimes prevented by smudge fires and other preparations for the expected freeze. The cold wave was ushered in by a northwest wind of about 30 miles per hour at New Orleans on the 24th and 25th, and a velocity of 34 miles per hour, preceded by rain and thunder at Port Eads on the 24th. At Wallace, at 7.15 a. m. of the 24th, the observer experienced first a dense fog bank and calm and then distinctly heard a sound like that of a tornado moving from the southwest toward the northeast, after which the wind at his station suddenly became very high and hail fell for a few seconds. [The general weather map shows that at this time the front of the cold wave was passing over the station at Wallace and the noise heard by the observer was very likely due to a whirl in the cloud region above him, since the front is generally characterized by a series of small violent whirls, sometimes horizontal, sometimes vertical.]

Minnesota.—Blizzards were reported on the 21st and 23d at Milan; 11th and and 21st, Barrett; at Belle Plaine on the night of the 10–11th; Warren on the 20th.

Mississippi.—The coldest day was the 25th, every station recording its lowest temperature on that date; this cold wave was the principal meteorological feature of the month; timely notice of its approach was given by the Weather Bureau in warnings telegraphed broadcast throughout the State.

Montana.—Cold waves occurred on the 2d, in the eastern portion of the State; on the 5th general cold weather prevailed, followed by a decided warm wave that remained until the 21st; 21st–23d, a general cold wave; slowly rising temperature in western Montana from the 23d to the end of the month.

New England.—The month was 2° to 5° above normal temperature in the southern, but several degrees colder in the extreme northern part. The observer at Fort Kent in northern Maine reports: "we have had extremely cold weather during January and my minimum thermometer has failed to record it; it is graduated only to —35°, and frequently I have found the index in the bulb while all the other thermometers in town recorded 45° to 50° below zero."

Oklahoma.—Oklahoma.—The second cold period prevailed from the 22d to the 27th; the lowest temperature was 8° below zero on the morning of the 24th; this cold wave was accompanied by possibly the worst blizzard ever experienced in this region. Lehigh, Choctaw Nation.—The first blizzard of the winter occurred on the 24th. Gwendale, Cherokee Nation.—A regular Dakota blizzard suddenly visited us on the 23d and 24th; the night of the 23d–24th was one of the coldest ever experienced here, the minimum was 3° above zero; the brisk winds drifted the snow so badly that it was impossible to get an accurate measurement. Clifton.—The storm of the 23d was a furious blizzard, and for the first two or three hours the precipitation was solid ice, sleet, or hail. Anadarko, Kiowa Nation.—The snow on the 23d was very dry, with a hard northeast wind, estimated about 4 inches. Healdton, Chickasaw Nation.—High south wind on the 23d followed by a blizzard on the 24th. Kemp.—Light snow on the 23d, temperature fell rapidly with the approach of the norther of the 24th.

Ohio.—The warm wave from the 1st to 11th culminated on the 4th, and that of the 13th to 23d culminated on the 18th and 21st with the highest mean daily temperatures of the month. On the 24th and 25th temperatures had fallen within twenty-four hours by from 30° to 50° under the advance of the most severe cold wave of the season. This cold wave first appeared to the north of Montana on Friday, 19th, and timely warnings were issued to all stations throughout the central valleys and Atlantic coast states.

Tennessee.—The cold wave of the 24–25th was the most severe since 1886; warnings of its approach were widely distributed throughout the State; it was more beneficial than damaging.

Utah.—The coldest days were generally the 5th, 6th, 9th, and 10th, and the warmest day was generally either the 15th or the 29th.

Washington.—Taking the State as a whole the mean temperature has been normal, but the rainfall has been the greatest since 1890, and the number of rainy days has been greater than for several years past; there was a cold snap from the 4th to 6th and a very warm period from the 12th to 14th.

Wisconsin.—The first twenty-two days were unusually warm; a severe cold wave entered the State during the night of the 21st–22d, and abnormally low temperatures prevailed from the 22d to the end of the month.

Wyoming.—The month has been noted for storms in the mountains; the observer at Sheridan reports storms from the northwest on the 18th and 23d.

FROST.

The following table shows the dates of the occurrence of the first light frost, the first heavy frost, and the first snowfall at the respective stations:

Dates of first light and heavy frosts and snow, January, 1894.

State and station.	First frost.		Snow.
	Light.	Heavy.	
Alabama.			
Florence			24
Greensboro			26
Selma			27
Arizona.			
Antelope Valley			4
Bisbee			4
Calabasas			5
Dudleyville			5
Eagle Pass			5
Natural Bridge			3
Reymert			4
Rye			4
St. Helena Ranch			4
Yuma		4	
Arkansas.			
Ashdown			24
Bee Branch			24
Blanchard Springs			24
Camden			24
Conway			24
Dardanelle			24
Mount Nebo			24
Newport			24
Osceola			24
Ozark			24
Rison			24
Rogers			23
Russellville			24
Winslow			23
California.			
Arcata			4
Chino		6	
Crescent City			4
Folsom City		5	
Jackson			2
Kennedy Gold Mine			3
Los Angeles		*6	
Milton (near)		5	
Mokulumne Hill			2
Newcastle		5	
Red Bluff			20
Redding			6
San Diego		†6	
San Francisco		5	
Sutter Creek			2
Ukiah			18
Florida.			
Amelia		‡31	
Deland		30	
Indian Territory.			
Eufaula			23
Kentucky.			
Fords Ferry			24

State and station.	First frost.		Snow.
	Light.	Heavy.	
Kentucky—Continued.			
Louisa			25
Pellville			24
Princeton			23
Louisiana.			
Bastrop			24
Coushatta			25
Farmersville			24
Liberty Hill			24
New Orleans		2	
Plain Dealing			24
Mississippi.			
Agricultural College			24
Clarksdale			24
Greenville			24
Itta Bena			24
Pontotoc			24
Thornton			28
Vicksburg			24
North Carolina.			
Shelby			26
Oklahoma.			
Anadarko			23
Fort Sill			23
Keokuk Falls			23
Mangum			23
Winnview			23
Oregon.			
Albany			3
Arlington			21
Cornelius			3
Corvallis			3
Jacksonville			4
Mount Angel			3
Umatilla			6
South Carolina.			
Hollands Store			26
Tennessee.			
Andersonville			24
Clinton			25
Jackson			24
Kingston			27
London			25
Texas.			
Aurora			23
Corpus Christi		24	
Galveston	1	24	
Grape Vine			10
Haskell			23
Highland			23
Mountain Springs			23
Weatherford			23
Wichita Falls			23

*Exposed vegetables and plants injured.
†Heavy frost in Mission Valley; vegetables injured.
‡Strawberries injured.

COLD WAVES.

The following special notes by Weather Bureau observers relative to the cold wave of January 23–24 are arranged geographically and chronologically so as to give an approximate idea of the progress of the front of the cold wave:

South Dakota.—Huron, 23d, snow began during the early morning and continued until 5.40 p. m., with brisk northwest winds. Trains delayed by drifting snow.

Kansas.—Dodge City, 23d–24th, the most severe norther that has visited this section in several years. At 8 p. m. of the 23d the temperature had fallen to —4, and by the morning of the 24th to —15.

Missouri.—St. Charles, 24–25th, the cold wave reported injurious to peaches. At Olden the temperature fell to —11. Fifty per cent of the peach buds killed.

Illinois.—Springfield, 23d–24th, snow began at 12.40 p. m., 23d, and continued until 4 a. m., 24th, during which time 5.5 inches fell. The storm was the heaviest in years, and owing to high wind drifted badly. The midnight train of the Illinois Central Railroad did not leave until 8 a. m., 24th. Delay was caused to traffic.

Indiana.—Laconia, 24–25th, the cold wave killed all peaches.

Michigan.—Grand Haven, 24th, the heaviest snowstorm of the winter prevailed all day, the snow falling at times in blinding sheets driven by a high northwest wind, which set in shortly before noon. The snow drifted in many places to a depth of nearly 2 feet. Railroad traffic interrupted.

Ohio.—Cincinnati, 24th, rain began in the early morning and changed to snow at 7.50 a. m., with rapidly falling temperature; snow ended at 12.55 p. m. The suddenness and severity caused much suffering, and business was partially paralyzed.

Tennessee.—Nashville. 24th, rain began at 3 a. m.; sleet began at 7.45 a. m., and changed to snow at 9.55 a. m., ending at 11 a. m.; beginning again at 11.40 and ending at 4.15 p. m. From 4 to 11 a. m. the temperature fell 42; considerable damage to telephone wires by sleet. Florence, 24th, the cold wave damaged wheat and winter oats. Covington, 25th, the temperature fell to zero; peach crop seriously damaged. At Nunnelly the temperature fell to —4; stock of all kinds suffered.

Texas.—State Weather Service, 23d–24th, the storm of sleet and snow was general throughout Texas, and in some places the weather was the coldest on record. Abilene, 24th, severe cold wave, with snow and high winds reaching a maximum velocity of 30 miles northwest; stock frozen. Terrell, 23d–24th, heavy rain began the afternoon of the 23d and changed to sleet at night; the wind blew a gale from the north; minor damage reported. Bonham, the blizzard struck this place at 5 p. m., 23d; rain and sleet fell, with high wind, and by the morning of the 24th the temperature fell to zero. At Whitewright a sleet and snowstorm began at 5.30 p. m. and lasted one hour; the wind continued all night from 30 to 40 miles per hour; minor damage. Luling, 24th, severe cold wave; oats and vegetables killed. San Antonio, 24th, a severe cold wave, with high north winds; temperature fell to 18; fruit trees and early vegetables badly damaged, and stock on ranges perished. Galveston, 24th, a severe norther occurred in the early morning with a maximum velocity of 50 miles per hour; a few hailstones fell at 3 a. m.; the first heavy frost of the season occurred in the morning. Corpus Christi, 24th, a severe norther struck here about midnight, followed by rain and freezing temperature; the temperature fell 46 from 8 p. m., 23d, to 8 a. m., 24th; the cold continued until the 25th, and the minimum at 8 a. m. of that date was 24, the coldest since January, 1888; all fruits, vegetables, and flowers killed; no estimate made of damage.

Louisiana.—State Weather Service, the cold wave of the 24–26th, injured garden vegetables and strawberries, and caused slight damage to cane; some fall-sown oats reported killed in northern portion. Abbeville, 24–27th, the severe cold froze garden plants and injured fruits. Roseland, 25th, a severe freeze; radishes, strawberries, and sprouts on fig trees killed. Coushatta, 25th, heavy frost killed oats.

Alabama.—State Weather Service, 25th, the cold wave caused strawberry plants and young cabbages to be destroyed.

PRECIPITATION.

[*In inches and hundredths.*]

The distribution of precipitation over the United States and Canada for January, 1894, as determined by reports from about 2,000 stations, is exhibited on Chart III. In the meteorological tables the total precipitation is given for each station; the departures from the normal are given for regular stations of the Weather Bureau in Table I of climatological data. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

NORMAL PRECIPITATION.

In January the monthly precipitation on the Pacific coast is usually greatest on the coasts of Washington and Oregon, where it exceeds 8.00. On the Atlantic coast the heaviest normal precipitation for this month is on the coast of North Carolina near Cape Hatteras. The precipitation is usually less than 2.00 over the interior region between the upper Lakes, Texas, and Idaho.

PRECIPITATION FOR JANUARY, 1894.

In January, 1894, the monthly precipitation exceeded 10.00 at a majority of the stations on the coasts of Washington, Oregon, and northern California, and exceeded 20.00 on the immediate coast of Oregon; it was between 4.00 and 6.00 in the interior of the eastern Gulf and south Atlantic States, and was less than 2.00 over the Lake region.

DEPARTURES FROM NORMAL PRECIPITATION.

The precipitation for January was in excess of the normal on the northern plateau, at Abilene, Tex., Missouri Valley, north and middle Pacific coasts, and middle plateau. It was generally deficient throughout the United States south of N. 45° and east of the Pacific slope. The principal deficits were: New Orleans, La., 3.6; Narragansett Pier, R. I., 3.3; Augusta, Me., 2.8; Savannah, Ga., 2.6; Chattanooga, Tenn., 2.5, and Montgomery, Ala., 2.4. The principal excesses were: Astoria, Oreg., 3.8; Tatoosh Island, Wash., 3.2; Walla Walla, Wash., and Eureka, Cal., 2.8.

Considered by districts the monthly precipitation for January, 1894, when compared with the normal for the month, furnished the following percentages (the precipitation is in excess when the percentage of the normal exceeds 100): Northern plateau, 189; Abilene, Tex. (southern slope), 132; Missouri Valley, 123; middle Pacific coast, 121; north Pacific coast, 120; middle plateau, 106; northern slope, 100; upper Lake region, 90; upper Mississippi, 85; North Dakota, 84; lower Lake region, 81; New England, 80; east Gulf States, 70; Ohio Valley and Tennessee, 69; south Atlantic States, 68; middle Atlantic States, 67; west Gulf States, 65; Key West, Fla., 57; south Pacific coast, 56; southern plateau, 24; middle slope, 22.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for January for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for January, 1894; (4) the departure of the current month from the average; (5) the extremes for January and the years of occurrence during the period of observation:

State and station.	(1) Average for the month of Jan.	(2) Length of record.	(3) Total for Jan., 1894.	(4) Departure from average.	(5) Extremes for January.			
					Greatest.		Least.	
					Am't.	Year.	Am't.	Year.
Arizona.	*Inches.*	*Years*	*Inches.*	*Inches.*	*Inches.*		*Inches*	
Fort Apache	1.21	18	1.24	+ 0.03	3.90	1886	0.18	1878
Fort Mohave	0.73	22	.....	.....	4.15	1889	0.00	*
Whipple Barracks	1.39	22	0.30	— 1.09	5.99	1886	0.00	1891
Arkansas.								
Keesees Ferry	2.81	12	1.84	— 0.97	7.37	1890	0.50	1893
California.								
Riverside	1.50	13	0.99	— 0.51	4.28	1890	0.00	1891
Colorado.								
Las Animas	0.29	12	0.00	— 0.29	0.85	1891	0.00	1893, '94
Florida.								
Merritts Island	3.28	16	1.63	— 1.65	10.45	1878	0.42	1892
Georgia.								
Forsyth	4.91	20	.16	— 0.75	10.08	1883	2.22	1880
Idaho.								
Boise Barracks	2.25	20	2.88	+ 0.63	4.60	1872	T.	1889
Fort Sherman	2.90	11	8.70	+ 5.80	8.70	1894	0.85	1893
Indiana.								
Lafayette	2.23	14	2.19	— 0.04	6.11	1880	0.40	1881
Iowa.								
Cresco	1.32	22	0.99	— 0.33	3.72	1886	0.38	1872, '84